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# RECREATIONS IN MATHEMATICS AND NATURAL PHILOSOPHY.

The following are answers to the two queries proposed in our 150th Number.

1. The origin of this problem is related in so curious a manner by Al-Sephadi, an Arabian author, that it deserves to be mentioned. A mathematician, named Sessa, says he, the son of Dahier, the subject of an Indian prince, having invented the game of chess, his sovereign was highly pleased with the invention, and wishing to confer on him some reward worthy of his magnificence, desired him to ask whatever he thought proper, assuring him that it should be granted. The mathematician, however, only asked a grain of wheat for the first square of the chess-board, two for the second, four for the third, and so on to the last or sixty-fourth. The prince at first was almost incensed at this demand, conceiving that it was ill-suited to his liberality, and ordered his vizier to comply with Sessa's request; but the minister was much astonished when, having caused the quantity of corn necessary to fulfil the prince's order to be calculated, he found that all the grain in the royal granaries, and that even of all his subjects, and in all Asia, would not be sufficient. He therefore informed the prince, who sent for the mathematician, and candidly acknowledged that he was not rich enough to be able to comply with his demand, the ingenuity of which astonished him still more than the game he had invented.

Such then is the origin of the game of chess, at least according to the Arabian historian Al-Sephadi. But it is not our business here to discuss the truth of this story; our business being to calculate the number of grains demanded by the mathematician, Sessa.

It will be found by calculation, that the 64th term of the double progression, beginning with unity, is 9223372036854775808. But the sum of all the terms of a double progression, beginning with unity, may be obtained by doubling the last term and subtracting from it unity. The number, therefore, of the grains of wheat equal to Sessa's demand, will be 18446744073709551615. Now, if a standard pint contains 9216 grains of wheat, a gallon will contain 73728, and, as eight gallons make one bushel, if we divide the above result by eight times 73728, we shall have 31274997412295 for the number of the bushels of wheat necessary to discharge the promise of the Indian king; and if we suppose that one acre of land is capable of producing in one year, thirty bushels of wheat, to produce this quantity would require 1042499913743 acres, which make more than eight times the surface of the whole globe; for the diameter of the earth being supposed equal to 7930 miles, its whole surface, comprehending land and water, will amount to very little more than 126487889177 square acres.

Dr. Wallis considers the matter in a manner somewhat different, and says, in his Arithmetic, that the quantity of wheat necessary to discharge the promise made to Sessa, would form a pyramid nine miles English in length, breadth, and height; which is equal to a paralleloiped mass, having nine square leagues for its base, and of the uniform height of one league. But as one league contains 15840 feet, this solid would be equivalent to another one foot in height and having a base equal to 142560 square leagues. Hence it follows, that the above quantity of wheat would cover, to the height of one foot, 142560 square leagues; an extent of surface equal to eleven times that of Britain, which, when every reduction is made, will be found to contain little more than 12674 square leagues.

If the price of a bushel of wheat be estimated at ten shillings, the value of the above quantity will amount to £15637498706147 10s. a sum which, in all probability, far surpasses all the riches on the earth.

2. By calculating as before, the 24th term of the progression 1, 2, 4, 8, &c. will be found to be 8388608, equal to the number of farthings the purchaser ought to give for the horse. The price therefore amounted to £3738 2s. 8d. which is more than any Arabian horse, even of the noblest breed, was ever sold for.

Had the price of the horse been the value of all the

nails, at a farthing for the first, two for the second, four for the third, and so on, the sum would have been double the above number, minus the first term, or 16777215 farthings, that is £17476 5s. 3½d.

Judging by the same system of calculating, it is not astonishing that the race of Abraham, after sojourning two hundred and sixty years in Egypt, should have formed a nation capable of giving uneasiness to the sovereigns of that country. We are told in the sacred writings, that Jacob settled in Egypt with seventy persons: now if we are to suppose that among these seventy persons, there were twenty too far advanced in life, or too young, to have children; that, of the remaining fifty, twenty-five were males and as many females, forming twenty-five married couples, and that each couple, in the space of twenty-five years produced, one with another, eight children, which will not appear incredible in a country celebrated for the fecundity of its inhabitants, we shall find that, at the end of twenty-five years, the above seventy persons may have increased to two hundred and seventy; from which, if we deduct those who died, there will, perhaps, be no exaggeration in making them amount to two hundred and ten. The race of Jacob, therefore, after sojourning twenty-five years in Egypt, may have been tripled. In like manner, these two hundred and ten persons, after twenty-five years more, may have increased to six hundred and thirty; and so on in triple geometrical progression: hence it follows that, at the end of two hundred and twenty-five years, the population may have amounted to 1377810 persons, among whom there might easily be five or six hundred thousand adults fit to bear arms.

If we suppose that the race of the first man, making a proper reduction for those who died, may have been doubled every twenty years, which certainly is not inconsistent with the powers of nature, the number of men, at the end of five centuries, may have amounted to 1048576. Now, as Adam lived about nine hundred years, he may have seen, therefore, when in the prime of life, that is to say, about the five hundredth year of his age, a posterity of 1048576 persons.

## QUERIES IN GEOMETRICAL PROGRESSION.

1. A club of seven persons agreed to dine together, every day successively, as long as they could sit down to table differently arranged. How many dinners would be necessary for that purpose?

2. Fifteen Christians and fifteen Turks being at sea in the same vessel, a dreadful storm came on, which obliged them to throw all their merchandize overboard; this however not being sufficient to lighten the ship, the captain informed them that there was no possibility of its being saved, unless half the passengers were thrown overboard also. Having, therefore, caused them all to arrange themselves in a row, by counting from 9 to 9, and throwing every ninth person into the sea, beginning again at the first of the row when it had been counted to the end, it was found that after fifteen persons had been thrown overboard, the fifteen Christians remained. How did the Captain arrange these thirty persons so as to save the Christians?

## "THE FORGET-ME-NOT."

This, the last of the *Annuals* for 1835 which it is our intention to notice, when formed into rank with the numerous class of publications of a similar order, which have recently appeared before the public, must be allowed to pass muster with considerable credit. We are compelled to say, however, that while it contains nothing which can in any way be offensive to a correct taste, or a cultivated understanding, there is nothing whatever of that impress of genius which we should expect to find in such a publication. No doubt, in several of the illustrations there is considerable cleverness, but in none of them can we discover anything which we could pronounce as an effort of real genius; and the same remark may be applied to the prose and poetry throughout the volume. Now, if we mistake not, it was with an intention of enabling artists of genuine talent to bring before the public efforts of the pencil or the chisel, that the *Annuals* were at first established. How far this was the case in earlier years we will not pretend to say, assuredly in by far the greatest

number of those for 1835, there is little of either genius or talent; and we are of opinion, that unless a greater effort is made, during the present year, to effect the object for which they were originally designed, there will be a considerable falling off in the sales of most of them. That "The Forget-Me-Not" for the year 1835, is fully equal to its predecessor, we do not deny; but we think it might be much improved, and we are anxious that it should be so, as it has all along been a favourite with us. The following simple story, "A Night Alarm," we insert, as an excellent example of the manner in which many of those extraordinary circumstances of supernatural intervention, which have from time to time been attested as matters of fact, could be explained in a very simple natural way. "In the soft and melodious tones," succeeded "by the harsh and grating sounds," our readers will readily recognize "the Banshee," as described in several of our former numbers. "The Snow," by C. Swaine, Esq. we consider as pretty a specimen of the poetry as any to be found in the volume.

#### A NIGHT ALARM

BY MRS. LEE.

It was eleven o'clock, and four young and lovely sisters had assembled in one room to hear the contents of a letter, which had arrived that morning from a distance. No matter what the letter said, but it may be presumed that it was unusually interesting; and the quickly approaching marriage of one of the parties might lead to an easy divination of its nature, were it necessary to the following narrative. The groupe thus collected was worthy of the most skilful painter, and, although any artist might have been improved by the attempt, the most consummate feeling and execution could alone have done justice to it.

As it most probably never will be painted, it may as well be described. The owner of the letter was in bed, but the broad lace border of the close cap could not hide the deep expression of that dark grey eye, or the admirable delicacy of that chiselled nose; the long and taper fingers, too, as they held the letter, bespoke an elegance of form well suited to the features. Another sister, half reclined on the foot of the bed, held the candle, the pale broad light of which discovered a countenance whose expression made even its regularity forgotten: every sentence of the letter was reflected in that ever varying face; everything that was good and tender, everything that was sad or joyous, might there be found, and nothing but what was unfeminine or bad could fail to meet with its corresponding image there. A third sister had suspended the brushing of her long glossy hair to listen to the tale; the intelligent look, the high commanding forehead, showed the mind of lofty and fixed purpose, and, as she rested one elbow on the pillar of the bed, she unconsciously displayed a form of faultless proportions. The party was completed by an arch rogue on her knees, whose beaming black eyes, half hidden by her raven ringlets, and whose delicate little foot, peeping from beneath the long dressing-gown, half excited a regret that she was more concealed than the rest.

The attention of all was deeply engaged, and nought was heard but the low and gentle voice of the reader, when a faint vibration of the window beneath, caused a cessation and a glance of inquiry from one sister to the other.—"It was only the wind," said the standing beauty, and the reader resumed her happy occupation. After a few more lines, the noise was repeated with greater force than before, and the kneeler sprang on her feet. "What can it be?" said she, in a scarcely audible tone. A long silence followed, and again came the sound, deeper and louder than ever, and it continued till the whole of the large dining-room window seemed to wring with the unaccountable tones, and to shake in every pane.

The house was built in the shelving part of some high cliffs, a succession of which bordered a lovely little bay on the eastern coast of England. It was not many yards from the sea; no habitation, except the station-towers of the preventive service, stood nearer than a quarter of a mile; the village was even more distant: a small old church, in which the sabbath was celebrated by a primitive

sort of service, stood on the top of a neighbouring hill, and nothing could be more tranquil or retired than the whole scene. It was perfectly refreshing to contrast it with the common-place, bustling, time-killing, dissipated, and frivolous resorts of those who seek but to get rid of themselves. And so secure was it deemed, from its retirement, that there was not even a fastening to the gates at either end of the shrubbery.

"Let us call papa," continued the raven-haired lass, "for I am certain it is some one breaking into the dining-room."

"Nonsense," observed the damsel of the brush; "no one would think of coming in here, and papa has been fishing all day, so we must not wake him on uncertainty. Look out, and see if any one is on the lawn."

No one, however, dared venture to go near the window; and, while all were considering what to do, the noise was reiterated with such force, that every rod of iron in the drawing-room balcony, close by, seemed to vibrate with the efforts made on the ground-floor.

"This is too much," said the hitherto silent candle-bearer; and one and all rushed into the gallery behind the room, not excepting the recumbent nymph.

They proceeded together to the chamber of a friend who was staying with them, and knocked at her door. On opening it, four long pale faces, huddled close to each other, presented themselves: but the visiter, being accustomed to such alarms in London, easily divined the nature of this unusual summons. The matter was whisperingly explained, and all five returned to the apartment where the noise had been heard, placed the candle in the gallery outside, and, shutting the door, waited in breathless silence. Expectation was soon realised, and courage was then assumed to look out into the garden; but all there was quite still.

It was then thought expedient to call the man-servant, who, with his wife, slept in another part of the house. Such efforts are always made in a body by females, and, therefore, the five ladies called the man, but his wife alone answered, saying that it was a false alarm—perhaps it was the puppy trying to get in—perhaps it was the wind: in short, it was any thing but a house-breaker. A moment's reflection seemed to convince the party that this fear was absurd; for, being only an occasional residence, no property of value which could afford temptation was kept there. But the noise was there, and whence could it proceed?

A walk along the cliffs, taken on that very evening, had discovered some haunts of smugglers, and very recent indications of their presence were found; besides which, one of the ladies had seen two men stealing along where there was no path, just at dusk, and, of course, they could have no good motive. Smugglers, therefore, were suggested as the primary cause of the alarm; and the idea of these lawless people having been closely pursued by the preventive men, and having taken refuge in their grounds, was much more tolerable to the ladies than that of housebreakers.

Whatever may be the cause, there certainly is in the female breast, a feeling of sympathy, or kindness, or interest of some sort, towards smugglers, and the first impulse is to assist them: but in the present instance horrors were conjured up, which entirely banished the little female partiality on which these men might otherwise have reckoned. Supposing it were possible for them to lodge their goods in the house, for the sake of concealment, the officers would soon arrive—a struggle would ensue—some would be wounded; their papa never would connive at the escape of a smuggler. But, in the midst of these deliberations and reflections, shake went the window—ring went the balcony—screach went the boat upon the shingles (as they thought)—and away rushed the ladies to the door of the sleeping host, begging him to rise immediately and see what was the matter.

The good-humoured readiness of the father, and his speedy appearance, showed that no hesitation need have been made in asking his help. The fears were soon related; the noise was listened for, but in vain; the house was inspected, the females following at a respectful distance, though, of course, ready to attack any body who

might endanger the safety of papa : but there was neither a trace of kegs nor of bales in the dining-room, nor were footsteps to be perceived on the soft gravel or dewy lawn in the garden ; no puppy, even—for every animal on the premises, except the human species, was buried in profound sleep. Nothing uncommon was to be seen, except a lighted candle in a lantern, standing on the kitchen hearth, which certainly looked like the attention of a wife towards an absent husband, and confirmed the ladies in their suspicions that there was connivance with smugglers somewhere.

What the master of the house thought no one ever knew, for he was not a man to betray his feelings without a necessity for doing so. He quietly asked his daughters and his guest if they were satisfied that all was safe, and advised them to retire to rest : but a keen observer might have discovered a lurking expression of mischief in his eyes, which told that they were spared only till he had an opportunity of venting his tormenting observations. He himself soon gave audible proofs that he had resumed his slumbers, and, when their tongues were weary with conjecture, the ladies thought proper to go to bed also.

The reader of these pages, however, will be little versed in female weaknesses, if he or she supposes that they sought solitary repose. Could one bed have held the five they would all have shared it ; but, as the dimensions of the beds in the house would not admit of this arrangement, the five were distributed in two, and nought was heard throughout the night except some stealing footsteps outside, which there was no doubt proceeded from the returning man-servant, after his carousal in the village.

In the course of the ensuing summer, a near relation of the proprietor of this beautiful spot, with his wife, children and servants, went to the same house, for the sake of the sea air. After a few days' stay, the husband left his family, and in a few days returned. He fancied that he saw an unusually grave expression on the countenances of his lady and her attendants. "Is all well?" he exclaimed. "Quite well," was the reply; and the expression was so slight, that he could not make any remark upon it.

The evening closed in, and, taking their station in the dining-room, the lady occupied herself with her needle, and the gentleman began to answer the letters which had awaited his arrival. An unbroken silence ensued, which was interrupted by a low and gentle sound; the needle fell from the lady's fingers; in half a minute the noise was increased to a shrill, grating vibration, and gradually subsided into the softest and most melodious tones that ever issued from an Eolian harp. Occasionally it stopped, then rising to its utmost strength, the whole window shook, and the bars of the balcony above ran like echoes to the sounds beneath.

"We have heard this before," said the lady, starting up. "I would not tell you of it when you first came in, because I wished you to receive the full impression of this mystery. We have searched in every direction; we have listened and watched; we have done every thing in our power to account for it, but in vain: and my servants are more than half persuaded that it is supernatural."

She was interrupted by a return of the noise: it recommenced with a harsh, grating sound, and appeared now to come from the ceiling—now from the window—and now from the earth. At times it was so loud, that the lady and gentleman thought it was a boat hauled ashore, and flew to the window. A bright moonlight rendered every thing visible; but nothing of the kind was to be seen. The sound gradually ceased, as if retiring to a distance; and, for the first time in his life, the husband felt a superstitious feeling creeping over him, and began to think that there was more reason than he chose to acknowledge in the suppositions of his servants.

On the ensuing day, every endeavour was made to find out the cause of this mysterious music; but it baffled all research and defied every conjecture. The evening advanced, and all remained perfectly quiet; the lady and gentleman went into the next room to partake of some refreshment, and the music recommenced, exactly in the

same manner as before. The gentleman returned alone to the larger room, without a light, and, seating himself in the middle of the room, so as to be able to see all round him, determined not to go to bed till he had fully investigated the matter. He at length felt sure that the tones proceeded from the window, and, approaching it, he anxiously watched the shore and the sea, by the occasional and fitful gleams of moonlight. After five or ten minutes, the most heavenly tones seemed to proceed from behind him; and, turning his head quickly round, they at the same moment appeared to come from the window beside him. A feeling of awe, and perhaps terror, now assailed him, but he argued that, if he did not now convince himself of the fact, whatever it might be, he should be forever disturbed with the recollection of the circumstance; and, mastering his half-formed fears, he went to the window, and leaned his head against it. The music then seemed to be close to his face, and, for a moment, he recoiled; but, fixing his eyes on the same pane of glass, he beheld a dark speck upon the window. He tried to lay hold of it, but it eluded his grasp, and the tones continued with more beauty than ever. At length he struck the window smartly, and all was still.

He immediately procured a candle, and, calling his wife and servants, proceeded with them to the inspection of the mysterious spot. The music became loud and shrill, but the light discovered that all these vibrations—these Eolian sounds—these harsh gratings—these awful and heavenly tones—these attempts at robbery—and these frightened smugglers were occasioned by—a simple snail, which was crawling across the pane. As it drew nearer to the centre of the pane, the sounds became deeper and fuller, as it approached the edge, they were shrill as a fife. The occasional touching of its shell, in its course, and the greater or less slowness of the animal, produced the vibrations and harsh gratings, the former of which were increased according to their vicinity to the frame-work; and, as there were several snails crawling along at the same time, in different parts of the same window, and in different windows, the varied positions of the sounds at the same moment was easily accounted for.

About the time that the above circumstance happened, the sister-in-law of the writer was startled, while at work at a window which opened into a garden, by the shrillest sound she ever heard, and which she said afterwards she could only compare to the crowing of a cock close to her ears. For a few moments she was bewildered by it, but her active endeavours to ascertain the cause proved it to be also a snail. She placed snails on the window purposely, and heard all the varieties of vibration caused by the state of the animal, the size of the pane, and the distance from the framework.

#### THE SNOW.

The silvery snow !—the silvery snow !—  
Like a glory it falls on the fields below ;  
And the trees with their diamond branches appear  
Like the fairy growth of some magical sphere ;  
While soft as music, and wild and white,  
It glitters and floats in the pale moonlight,  
And spangles the river and fount as they flow ;  
Oh ! who has not loved the bright, beautiful snow !

The silvery snow, and the crinkling frost—  
How merry we go when the Earth seems lost ;  
Like spirits that rise from the dust of Time,  
To live in a purer and holier clime !  
A new creation without a stain—  
Lovely as Heaven's own pure domain !  
But ah ! like the many fair hopes of our years,  
It glitters a while—and then melts into tears !

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